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EXAMINER

ECKERT II, GEORGE C

ART UNIT	PAPER NUMBER
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2815

DATE MAILED: 01/03/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.  
09/755,071

Applicant(s)  
Ahn et al.

Examiner  
George C. Eckert II

Art Unit  
2815



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

1) ☒ Responsive to communication(s) filed on Oct 16, 2001

2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

## Disposition of Claims

4) ☒ Claim(s) 1-41 is/are pending in the application.

4a) Of the above, claim(s) 1-18 is/are withdrawn from consideration.

5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.

6) ☒ Claim(s) 19-41 is/are rejected.

7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.

8) ☐ Claims \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on Jan 8, 2001 is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. § 119

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some\* c) ☐ None of:

- ☐ Certified copies of the priority documents have been received.
- ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_
- ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

## Attachment(s)

- 15) ☒ Notice of References Cited (PTO-892) 18) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 19) ☐ Notice of Informal Patent Application (PTO-152)
- 17) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 3 20) ☐ Other:

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## DETAILED ACTION

### *Election/Restriction*

1. Claims 1-18 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 5.

### *Drawings*

2. Figures 1-3 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g).

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 19-25, 28-34 and 37-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,565,707 to Colgan et al. in view of US 6,093,966 to Venkatraman et al. Colgan et al. teach, with reference to figure 1:

a substrate 15;

a metal layer 16 provided within the substrate;

a first insulating layer 22 located over the substrate;

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a via (filled by contact stud 24) within the first insulating layer 22 and extending to at least a portion of the metal layer; and

a second insulating layer 34 located over the first insulating layer.

With regard to claim 21, Colgan et al. teach that the first insulating layer may be formed of silicon oxide (col. 4, lines 21-22). With regard to claims 23-25, Colgan et al. teach that the second insulating layer 34 may be formed of silicon dioxide or polyimide and is formed to a thickness of 100 - 3000 nm (1000 - 30,000 Å). With regard to claim 29, 30, 38 and 39, Colgan et al. teach that the substrate is silicon (col. 4, line 19).

Colgan et al. do not teach that a trench is formed in the second insulating layer or that the trench and via are lined with a titanium-silicon-nitride (Ti-Si-N) layer and filled with a copper material. Venkatraman et al. teach, with reference to figures 4-10, a damascene structure including an underlying metal layer 170, a first insulating layer 180 and a second insulating layer 190 formed above the metal layer wherein a via is formed in the first insulating layer 180 and a trench is formed in the second insulating layer 190. Furthermore, Venkatraman et al. teach that the via and trench are lined with a barrier layer 200 which may be comprised of titanium-silicon-nitride (col. 5, lines 22-26) and are filled with a copper material 210 (col. 6, line 29).

With regard to claims 20, 22 and 32-34, Venkatraman et al. teach that a first insulating layer 180 may be formed of silicon dioxide or polyimide and to a thickness of less than 20,000Å (col. 4, lines 39-54). With regard to claims 28 and 37, Venkatraman et al. teach the use of copper as a preferred metal for a conductor (col. 1, lines 15-19). With regard to claims 40 and 41,

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Venkatraman et al. teach the use of the damascene structure in an integrated circuit (see figure 3); regarding the use of a processor coupled to and on the same chip as the integrated circuit, it is considered obvious and well known in the art that an integrated circuit is often used with a processor.

Colgan et al. and Venkatraman et al are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form the form the damascene structure of Venkatraman et al. in the device of Colgan et al. The motivation for doing so, as is taught by Venkatraman et al., is that such a damascene structure which uses copper as the conductor and Ti-Si-N for a liner provides for a low resistance connection while preventing copper migration into the underlying substrate or dielectric (col. 1, lines 13-40). Therefore, it would have been obvious to combine Colgan et al. with Venkatraman et al. to obtain the invention of claims 19-25, 28-34 and 37-41.

4. Claims 26, 27, 35 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Colgan et al. and Venkatraman et al. as applied to claims 19 and 31 above, and further in view of *Ti-Si-N Diffusion Barriers Between Silicon and Copper* to J. S. Reid et al. Colgan et al. and Venkatraman et al. taught the device of claims 19 and 31 but did not teach the device wherein the Ti-Si-N liner layer is between 50 - 200Å or specifically 100Å thick. J. S. Reid et al. teach on page 299, in the right hand column, first full paragraph, that a layer of Ti-Si-N may be formed at a thickness of 10nm (100Å).

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Colgan et al. and Venkatraman et al. are combinable with J. S. Reid et al. because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form the Ti-Si-N layer to a thickness of 100Å. The motivation for doing so, as is taught by J. S. Reid et al., is that such thickness is sufficient to prevent copper migration up to a temperature of 650°C. Therefore, it would have been obvious to combine J. S. Reid et al. with Colgan et al. and Venkatraman et al. to obtain the invention of claims 26, 27, 35 and 36.


*Conclusion*

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The cited art is considered relevant to applicant's field of endeavor.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to George C. Eckert II whose telephone number is (703) 305-2752.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Eddie Lee can be reached on (703) 308-1690. The fax phone number for this Group is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

  
George C. Eckert II  
Patent Examiner  
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December 28, 2001